The Distribution and Population size of the Mute Swan (*Cygnus olor)* in Warwick – A short study

Introduction

This short paper deals with the analysis of the size and breeding distribution of the Mute Swan (*Cygnus olor*) in the immediate Warwick area. It discusses the number of available and utilised breeding sites and the changing patterns in winter herd sizes over a period of six years.

The Study Area.

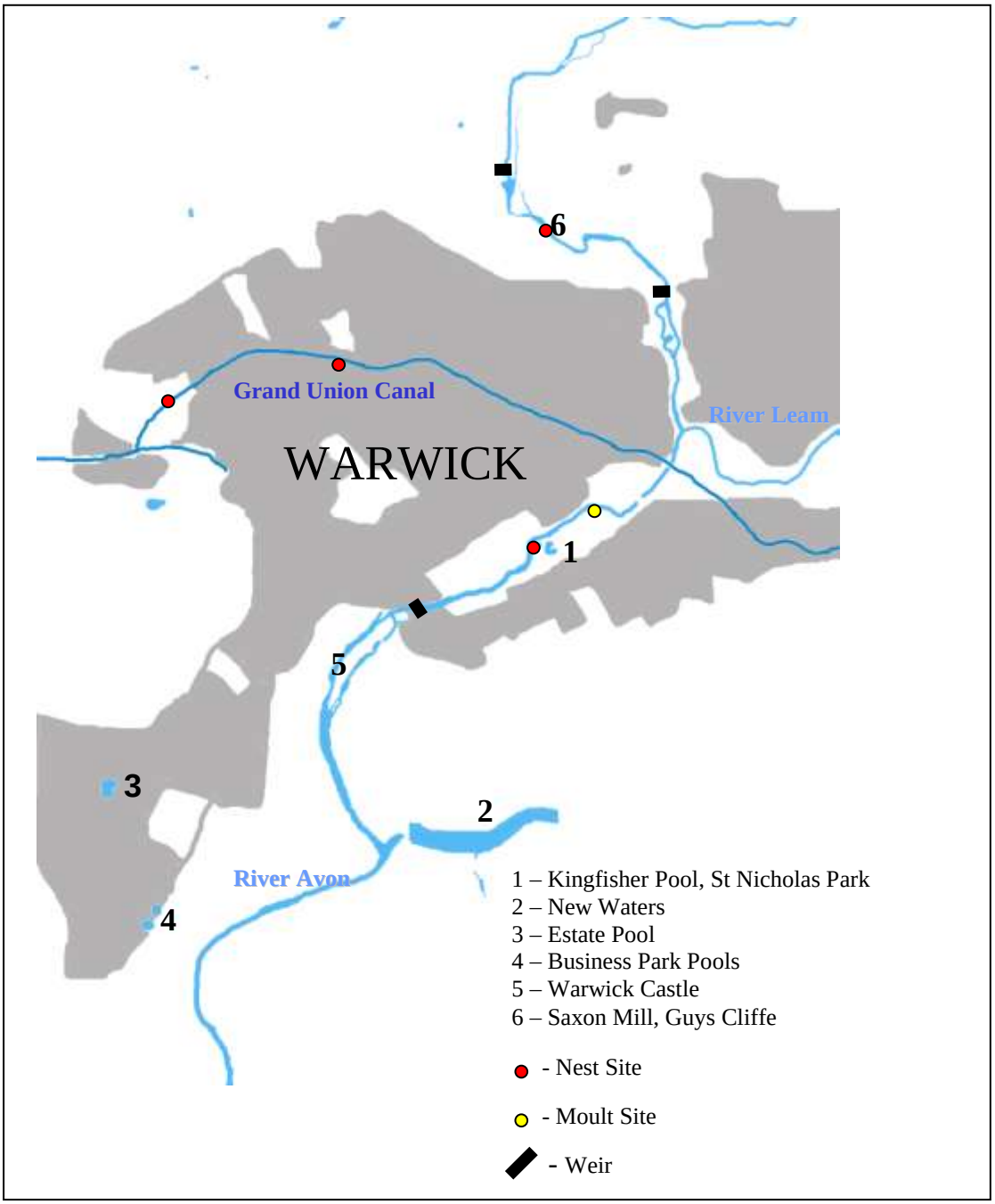
The study area covers 30 square kilometres centred on Warwick. It includes approximately 10 km of rivers, 6.4 km of canals and approximately 75 hectares of open water such as lakes and ponds (Figure 1).
The region is dominated by the Warwick conurbation, which constitutes 20% of the study area. The surrounding matrix is farmland, mostly arable with some pasture along parts of the river corridor and towards the north west of the study plot.

The main habitat for Mute Swans is the River Avon (9.2 km) that runs between the towns of Warwick and Leamington. It flows from north to south rising near Naseby in Northamptonshire and joining the River Severn at Tewkesbury. The section of river passing through Warwick is termed the 'Higher Avon' and is joined by a single main tributary, the River Leam (0.75 km), which also rises in Northamptonshire from a spring near Helidon.

The study site is bisected east to west by the Grand Union Canal (6.4 km), which connects to the Stratford Canal and Birmingham to the west, and the Oxford Canal to the east. Much of this canal basin is unsuitable for breeding with much of the canal side through Warwick and Leamington being well-maintained and providing few nesting locations. Bank degradation along the canal through the Woodloes Park housing estate has resulted in the establishment of a *Phragmites* sp. reed bed and has been used as a nest site for at least 10 years.

Originally the only substantial body of water in the area was New Waters. This large lake once part of the Warwick Castle estate is the result of the damning of a number

Figure 1. Map showing the Study Area and the nest



of small streams that flow into the Avon just south of Warwick. Encroachment by reed beds means that only two thirds of the site remains open water.

In recent years a number of additional lakes and pools have been dug. In the late 1990's Heritage Lottery money helped create Kingfisher Pool in St Nicholas Park in Warwick as a site for disabled anglers. The main pool and a smaller subsidiary has become well established now and is a regularly used nesting site. In 2005 and 2006

increased construction on rough grassland to the south of Warwick necessitated that three lakes be created to drain the land. The first lake, referred to in this document as Estate Pool was created in 2005. A further two were finished in 2006 and form the focus for the entrance to a new business park at a traffic island on the Stratford Road.

Study Methods

This paper is the culmination of a collection of Swan sightings and recording between 2003 and 2006. Each stretch of suitable habitat was surveyed several times each year with special attention paid to the location of nesting pairs and the size and location of wintering herds.

On each visit every effort was made to record the location and identity of all swans encountered. Individuals were identified by the reading of DARVIC ring tags or by distinctive markings.

a) Calculating population size

On the whole population estimates were made by direct counts however its soon became evident that there could in fact be a larger number of individuals moving in and out of the area that couldn't be quantified due to the lack of identifiable features or DARVIC rings. Mark-recapture-release methods are designed to estimate population sizes from two closely collected data sets (Box 1). The correct identification of DARVIC rings provides a very basic ready made marking system. In this way n_1 was identified as the number of swans in the sample bearing a DARVIC. These tags were recorded and compared to those collected in the second sample thus rendering m_2; n_2 represented all swans without tags or those with previously unrecorded tags in the second sample. From this a basic population estimate with 95% confidence limits was established.

Box 1 Petersen Index

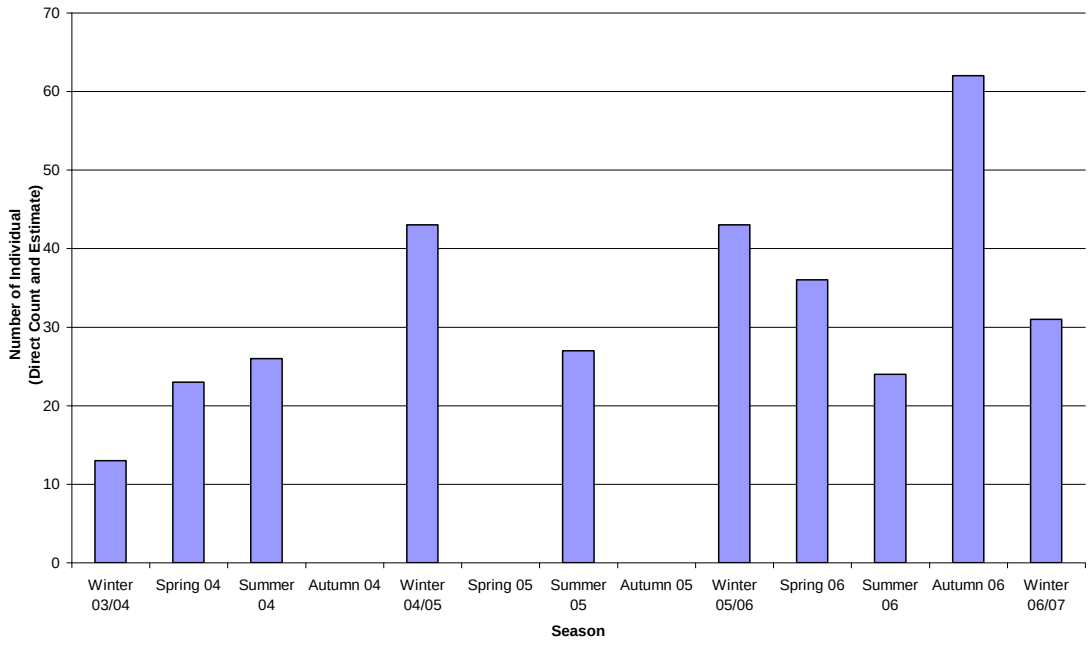
$$\mathbf{N = n_1 – n_2 / m_2}$$

Population Size

a) The Warwick Area

The study area has 4-5 resident pairs that generally do not move out of the area. Swan numbers in 2003 were low representing only the resident pairs, a pair of non-breeders and any post dispersal offspring. This changed from 2004 when swan numbers in the whole area began to steadily increase with some substantial winter peaks where winter herds were supplemented from outside populations. Some of these visitors formed a non-breeding flock in 2006 that dispersed only once cygnets hatched. The average size of the Warwick population is 33 individuals (Figure 2) giving a density of 0.9 individuals per km^2 or 0.05 individuals per km_2 of available habitat.

Figure 2 Estimated Warwick Population Size



b) St Nicholas Park

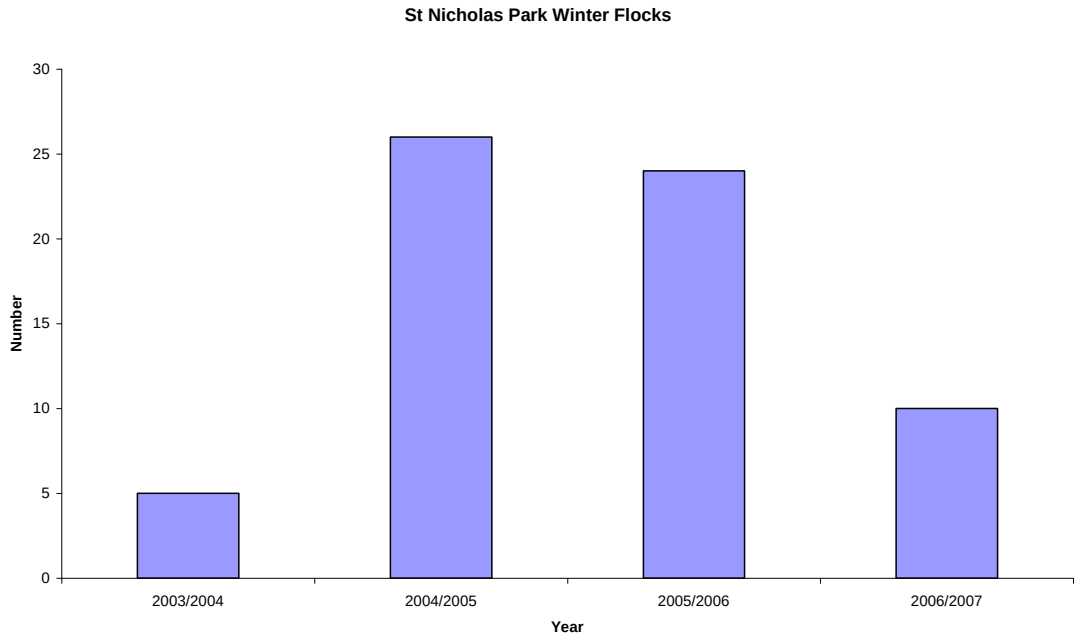
St Nicholas Park is both the site of moulting and wintering herds. J.A Hardman (1980) established the location of a moult site on the Avon just up river of the park. The site is a low bank bordering the County Council Sports Field and was still in use in 2006.

In most winters the St Nicholas Park herd generally reached small numbers (Figure 3). The resident pair, an older aggressive male (ZON) and any offspring were usually

only those that remained however in the winter of 2004/2005 the herd size dramatically increased. The resident pair up stream of the Park at the Saxon Mill brought their cygnets downstream to join the resident pair. 28 individual swans were recorded frequenting the site between December 2004 and March 2005 with maximas of 26 swans at any one time. The herd established itself at a footbridge by a slipway. This was away from the main feeding station were locals feed the ducks which at the start of the season was still guarded by a single male (ZON) maintaining a territory, nevertheless the large number of swans soon drew attention and people began to feed them near the bridge.
The herd dispersed in March as territories were re-established by the resident pair (ZOT/ZTG) and ZON.

The following winter (2005/06) a similar number of individuals were recorded with 34 individuals being identified between December and February
The age distribution of the herds however differs significantly between the two periods. The 2004/05 herd was mostly 2nd winter individuals and Adults. Only 41% were that year's cygnets in their 1st winter plumage, whilst unusually the 2005/06 herd was comprised of mostly 1st winter individuals (63%) with only a very small number of 2nd winters. The adult count in both years was approximately the same.

Figure 3. Winter herd sizes at St Nicholas Park



In winter 2006/07 large flocks were entirely absent with only the 4 resident adults being present, even a second breeding pair and their cygnets had left the site by the end of November. Instead the main wintering flock was observed at the new pools located on the southern edge of the town. These new pools attracted swans from outside the study area and herd sizes between the three pools reached a maximum of 41 individuals in November with numbers falling in early December and with only 8 at New Year. The swans at this site were essentially new swans to the area although 5 individuals were identified as having spent either the last winter or spring (their first year) at St Nicholas Park and in one instance one was identified as a first year juvenile that had been born on the Grand Union Canal earlier in the year. Large numbers of these herds however remained unidentified despite the fact that many had DARVICS; it is suspected that many more from the area including more of this year's offspring were in fact present.

c) Mobility of the population

As already suggested many of the swans identified in the winter flocks are from outside of the study area and that likewise many of those born within the study area are rarely recorded there again. There is some evidence that nesting adults along the Grand Union Canal and upstream at the Saxon Mill return to St Nicholas Park in some winters. It is also clear that on the whole the Saxon Mill pair raise their young to fledging age within a short distance of the nest site then take them downriver to St Nicholas Park. The weir on the route would prohibit a pair taking cygnets at any earlier stage. Like wise when the female (VGY) lost her mate in February 2006 she was very quickly observed joining the main flock at the park and displaying a great deal of mating behaviour. In fact she selected a new mate, an untagged individual who she then led back to her normal nest site.

It is interesting to note that it is very rare for individuals to mix between the canal and the park. The canal does intersect the river at the park but does so by way of an aqueduct. The canal passes over the river at some height. It is possible that this provides some barrier to dispersal and that the swans on the canal prefer to disperse along its length rather than move to the river.

A second barrier appears to be the weir on the Avon by the Castle. This separates the territory of ZON and VAO. The swans associated with the Castle stretch and New Waters do not seem to come further upstream than this point

Breeding Analysis

a) Utilisation of nest sites

Mute Swans are highly selective in their choice of nest site. Their main priority is a quiet secluded spot with a bank side that allows easy access to and from the water (Birkhead and Perrins, 1986). Often islands are chosen which afford them some protection from predators such as foxes. Nest sites tend to be used year on year by a pair and in the study area some sites are inherited by other pairs once the previous pair have either left or have died.

The study area contains eight suitable breeding locations. These locations were identified either as sites where individuals were already breeding or were deemed should be breeding (Figure 4).

The most productive sites in the area are at Kingfisher Pool in St Nicholas Park and the Margaret Hall site on the Grand Union Canal. Both sites have had continuous occupancy for at least 10-15 years. Both these sites are typical of urban nest sites. They are both situated in reed beds situated on the bank side. In the case of Kingfisher Pool the nest is located between the pool and the river and at some height above the river. The adults generally take cygnets into the pool until they are significantly older before moving them on to the river.

These two locations are neither quiet nor secluded, both walkers and boaters use both the canal and the river heavily. Disruption is minimised by the Park Keeper at St Nicholas Park who normally erects a fence around the nesting pair to protect them from vandals. The Grand Union Canal site was originally close to a footbridge and often the subject of vandalism, the subsequent growth of a reed bed on the opposite side of the towpath further upstream has meant that the pair is afforded greater protection.

Figure 4. Number of Pairs (Territories)

Potential Site		2002	2003	2004	2005	2006
River Avon	Old Milverton	0	0	0	0	0
	Saxon Mill	1	1	1	1	1
	St Nicholas Park	1	1	1 (1)	1 (1)	2 (1)
	Warwick Castle	?	?	?	1	1
Lakes	New Waters	?	?	0	0	0
	Estate Pool	-	-	-	0	0
	Business Park	No suitable breeding Site at present.				
Grand Union Canal	Margaret Hall	1	1	1	1	1
	Wedgnock	0	0	1	0	0
	Total	**3**	**3**	**5**	**5**	**6**

Further up the Avon past the confluence with the River Leam a pair has successfully nested (VGY and ZNY) since 2002 (Saxon Mill). At first the nest was not located but believed to be along inaccessible bank sides between a factory unit and a dog track. When the factory unit was demolished and construction of houses and apartments began the pair abandoned this site and moved to a small mud bank further upstream on the bank of Guys Cliffe House. Here the site was much more secluded and closer to the feeding grounds and the area in which they traditionally raised their cygnets post hatching. The mud bank is however subject to flooding and the nest was lost in 2006.

Of the nine sites only 4-5 are ever used in any one season, this could be due to a lack of individuals of a breeding age to take up a territory. It has already been noted that recent winter flocks consist mainly of 1st and 2nd winter individuals who are not of breeding age. It is rare for any of these to remain into their third year. In early 2006 VGY lost her mate and rejoined the herd at St Nicholas Park successfully selecting a new mate and attempting to breed in the spring. Likewise a cygnet born in 2004 on the Grand Union Canal returned and bred at the natal site in 2006 after their own parents had abandoned the site. This suggests that there is some movement between

pairs and adults but that there are not enough individuals of breeding age either entering or remaining in the area to establish new territories.

It is also possible however that the other sites are not as suitable for breeding as it appears. Upstream of the Saxon Mill towards Old Milverton sites are not used despite extensive reed beds; here the river is narrower and faster flowing and a lot more prone to flooding. New Waters seems to be an ideal habitat for breeding and could support more than one pair. This site is on very secluded private land but perhaps has a higher predation risk from foxes.
The new lakes dug in the south of the town offer some future nesting sites, the Estate Pool is reaching a point where its vegetation is making it a more suitable location whilst the newer Business Park ones are still too new and have too much bank side fencing to be suitable at this time. It is unlikely their management will improve the sites nesting potential.

b) Breeding Success

In a three-year period (2004-2006) five pairs produced a total of 47 cygnets of which 36 survived to fledge (76.6% survivorship) (Figure 5). Most individuals were lost within the first week or so as is reflected in most of the literature which states that 10 to 15% of a brood can expect to die in the first fortnight after hatching (Birkhead and Perrins, 1986).

Figure 5. Warwick Breeding Success

Year	**No. Nest Located**	**Percentage of nests successful**	**Total No. Of Cygnets Hatching**	**No. Reaching fledging**	**Percentage Survival**
2002*	2	2	4+	3+	~75
2003*	2	2	6+	3+	~50
2004	4	4	19	16	84
2005	4	4	16	12	64
2006	4	2	12	8	64

*No full survey undertaken, therefore under representative.

In the case of the study area total survivorship to fledging is 16% higher than the national average (based on mean values of all studies - Birkhead and Perrins, 1986). Of all the breeding attempts the only nest stage failures were in 2006 with one nest

being washed away, another failing possibly due to the age of the pair and the last one for unknown reasons.

The nest site and pair in the study area with the greatest data is the Saxon Mill pair (Figure 6). Originally the pair nests in an unknown location but in 2004 construction forced them to move to a more obvious site. Clutch sizes have traditionally been between 5 and 6, which compares favourably to the national average of 5.58 eggs per clutch (Birkhead and Perrins, 1986). Likewise the lay date is in line with the national average (18th April). The female (VGY) is currently 14 years old, which is twice the typical lifespan of a wild swan, and her first mate (ZNY) was of a similar age. The survival of individuals at this site is considerably lower (57.6%) than the study area average this is probably due to the presence of fox and mink on the site.

Figure 6. Saxon Mill Success

	Est. Lay Date	**Hatch Date**	**No. Hatch**	**No. Fledge**	**Percentage Survival**
2002	8th-14th April	19th May	~3	2	67
2003	7th-13th April	18th May	6	3	50
2004	12th-18th April	23rd May	6	3	50
2005	11th-17th April	22nd May	5	3	60
2006	Washed Away	-	-	-	-

Discussion

It is evident that the immediate Warwick area has a stable and productive population of swans. Whilst the large herds seen in 2005/06 seemed to suggest that the River Avon at St Nicholas Park could become as popular the large herds seen downriver in Stratford upon Avon it is more likely that this was a rare event. Large numbers did return in 2006/2007 but this time at the Business Park and Estate Pools. These herds were almost entirely 1st and 2nd winter individuals with very little movement between them and the local birds. The herd was less persistent forming in late November and mostly dispersing by the end of January. This dispersal was outside of the Warwick area with only a handful remaining at the lakes and a pair moving onto the canal.

The area supports a productive number of breeding pairs who favour well established nest sites close to good feeding grounds. There appears to be plenty of extra habitats available for breeding elsewhere in the area but it remains to be seen if 2nd winter

individuals from the over wintering herds will move into to utilise these. This ability for new pairs to enter the area is particularly important due to the increasing ages of the currently resident pairs.

Evidence for the 2007 breeding season is favourable with the resident pairs reforming and possible signs of a new pair in the area and the possibility that the lone male (ZON) will pair. It is however unlikely that the Wedgnock site is suitable with considerable encroachment of the reed bed by brambles.

Future analysis will focus on the wider distribution of Mute Swans in Warwickshire and an examination of dispersal patterns as well as continuing to monitor and report on the existing pairs in Warwick in the coming years.

References

Birkhead, M. and Perrins, C (1986) *The Mute Swan*
Croom Helm. London

Hardman, J and Cooper, D (1980) Mute Swans on the Warwickshire Avon – a study of a decline.
Wildfowl 31 pp29-36